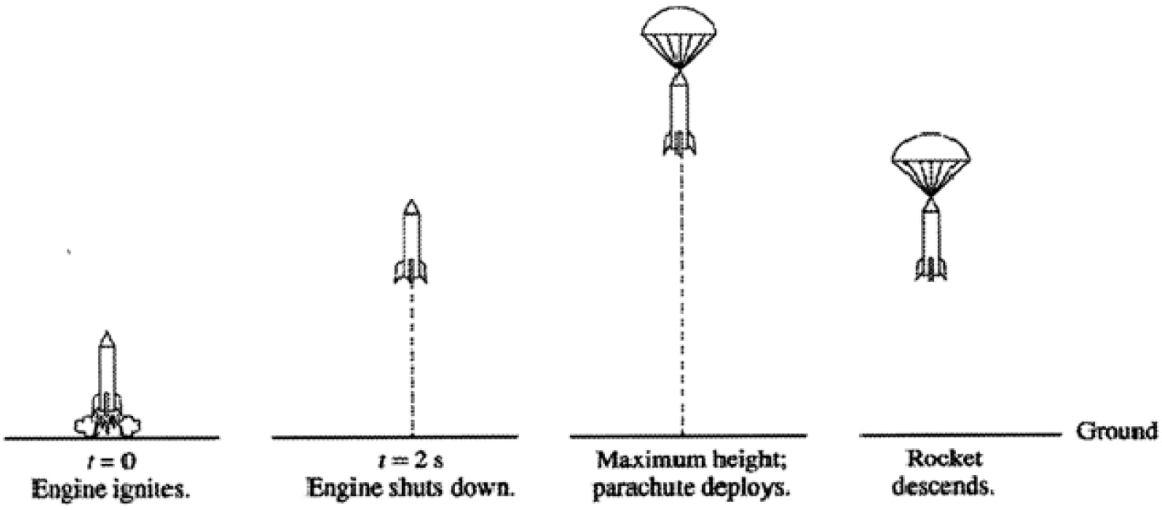


Note: Figures not drawn to scale.

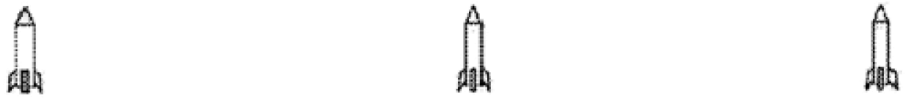
2002B1. A model rocket of mass 0.250 kg is launched vertically with an engine that is ignited at time t = 0, as shown above. The engine provides an impulse of 20.0 N•s by firing for 2.0 s. Upon reaching its maximum height, the rocket deploys a parachute, and then descends vertically to the ground.

(a) On the figures below, draw and label a free-body diagram for the rocket during each of the following intervals.

i. While the engine is firing

ii. After the engine stops, but before the parachute is deployed

iii. After the parachute is deployed



(b) Determine the magnitude of the average acceleration of the rocket during the 2 s firing of the engine.

(c) What maximum height will the rocket reach?

(d) At what time after t = 0 will the maximum height be reached?

(e) Instead of taking off on Earth, this same model rocket is taking off on Mars. Given that the gravitational acceleration on Mars is less, how will this qualitatively affect a) the FBDs; b) the average acceleration during the first 2 sec; c) the maximum height; d) the time after t=0 the maximum height is reached?